Validation Of Rain Rate Retrievals For The Airborne Hurricane Imaging Radiometer (HIRAD)

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Abstract

NASA’s Global Hawk aircraft (AV1) has two microwave sensors: the passive Hurricane Imaging Radiometer (HIRAD), and the active High-altitude Imaging Wind and Rain Airborne Profiler (HIWRAP). Results are presented for a rain measurement validation opportunity that occurred in 2013, when the AV1 flew over a tropical squall-line that was simultaneously observed by the Tampa NEXRAD radar. During this experiment, Global Hawk made 3 passes over the rapidly propagating thunderstorm, while the TAMPA NEXRAD performed volume scans every 5-min. In this poster, the three-way inter-comparison of HIRAD Tb, HIWRAP dbZ and NEXRAD rain rate imagery are presented. Also, observed HIRAD Tbs are compared with theoretical radiative transfer model results using HIWRAP Rain Rates.

INTRODUCTION

HIRAD is a collaborative effort of NASA MSFC, CFRSL, and Univ. of Michigan

HIRAD & HIWRAP flew on an unmanned Global Hawk UAV, in NASA’s Hurricane and Severe Storms Sentinel (HS3) flight program

Sept 2013 AV1 flew over a tropical squall-line of thunderstorms in the Gulf of Mexico, near Tampa Bay

- These rain events were simultaneously observed by NOAA’s National Weather Service NEXRAD

INSTRUMENTS OVERVIEW

HIRAD

- 4-freq C-band Radiometer
- 4, 5, 6 & 6.6 GHz

HIWRAP

- Dual freq (Ka- & Ku-band), dual-beam, conical scan Doppler Radar
- Measures line-of-sight & surface winds from volume backscattering of clouds & rain

CONCLUSIONS

- Results demonstrate an excellent correlation in the 3-way comparison of spatial patterns:
  - NEXRAD rain rate, HIRAD Tb @ 5 GHz and HIWRAP dbZ
  - HIWRAP Z-R relationship tuned to NEXRAD rain rates
- HIRAD observed Tb calibration tuned to radiative transfer model (RTM) calculations
- HIRAD Tb forward RTM uses the 3D rain patterns inferred by HIWRAP

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